Ki‘ilae Farms
Entrance Road & Subdivision Road Improvements Projects
Ki‘ilae, South Kona, Hawai‘i
Site-Specific Best Management Practices Plan
TMK 8-5-05:19 & 22

April 2004

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KIʻILAE FARMS

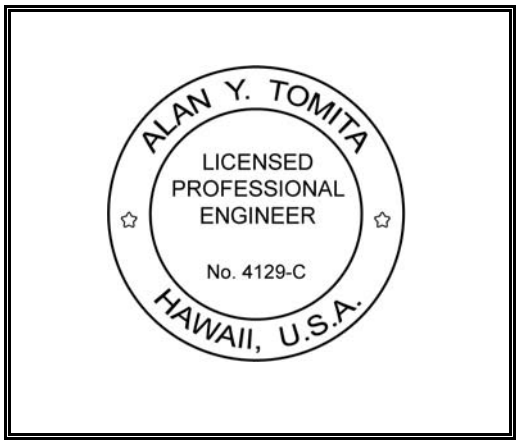
Entrance Road & Subdivision Road Improvements Projects
Kiʻilae, South Kona, Hawaiʻi

Tax Map Keys 8-5-05:19 & 22

SITE-SPECIFIC BEST MANAGEMENT PRACTICES PLAN

State of Hawaiʻi, Department of Health, Clean Water Branch
File No. 0021806

April 2004



This work was prepared by me or under my direct supervision.

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Signature Date
M & E Pacific, Inc.

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BEST MANAGEMENT PRACTICES PLAN

Project Summary & Schedule

The project consists of entrance road and subdivision road improvements for the Ki'ilae Farms site. Project work will be performed in phases, starting with the entrance road work, and continuing on with the construction of the subdivision roads over 5 phases. Drainage and Erosion Control Reports contain site-specific information regarding estimated runoff, water quality and soil loss impacts of the project.

The construction Notice to Proceed (NTP) is anticipated to be issued in April/May 2004. The anticipated construction schedule is as follows:

Task	Duration
• Installation of all Best Management Practices, BMPs, for all phases of construction work (silt fence, crushed rock ingress/egress, interceptor swales, sedimentation basins, etc.)	30 cal days
• Intersection improvements at Hawai'i Belt Road and subdivision road "A" and connection to existing water system	60 cal days
• *Phase 1*—Clearing & grubbing	14 cal days
• *Phase 1*—Construction of subdivision road & infrastructure	30 cal days
• *Phase 1*—Finish grading, landscaping/grassing & paving	7 cal days
• *Phase 2*—Clearing & grubbing	14 cal days
• *Phase 2*—Construction of subdivision road & infrastructure	30 cal days
• *Phase 2*—Finish grading, landscaping/grassing & paving	7 cal days
• *Phase 3*—Clearing & grubbing	14 cal days
• *Phase 3*—Construction of subdivision road & infrastructure	30 cal days
• *Phase 3*—Finish grading, landscaping/grassing & paving	7 cal days
• *Phase 4*—Clearing & grubbing	14 cal days
• *Phase 4*—Construction of subdivision road & infrastructure	30 cal days
• *Phase 4*—Finish grading, landscaping/grassing & paving	7 cal days
• *Phase 5*—Clearing & grubbing	14 cal days
• *Phase 5*—Construction of subdivision road & infrastructure	30 cal days
• *Phase 5*—Finish grading, landscaping/grassing & paving	7 cal days
• Removal/Filling of temporary BMPs	7 cal days

Completion of project work is estimated to be in January/February 2005, or roughly 9 months after NTP issuance.

Construction Activities & Equipment

The anticipated types of materials and heavy equipment to be used for different construction activities of the project are summarized in Table 1.

Table 1
Expected Activities and Heavy Equipment Used for the Ki'ilae Farms, South Kona, Hawai'i Project

Construction Activity	Material	Heavy Equipment
Clearing and grubbing	None	Bulldozer, backhoe, haul trucks
Grading	On-site fill	Compactor
Dust control	Fresh water	Watering truck
Water lines	Pipe cushion	Flatbed trailer-truck, backhoe
Road construction	Subbase, base, AC pavement, concrete pavement	Concrete mixer, AC mixer, paver, haul trucks, roller, crusher

Potential Pollutants & Best Management Practices

Table 2 summarizes the potential pollutants for the project, their sources and mitigation and contingency measures.

Table 2
Potential Pollutants, Sources and Mitigation Measures for the Ki'ilae Farms, South Kona, Hawai'i Project

	Potential Pollutant	Sources	Mitigation Measures	Contingency Plan
1.	Soil in runoff	Erosion of natural ground at site	• Silt fences • Roadside ditches and swales • Interceptor swales • Gravel filter berms • Sedimentation basins • Natural basin for Phase 1 • Gravel berm and silt fence along *makai* edge of Phase 5 sedimentation basin • Landscaping • Grassing • Mulching • Phasing of work and 5-acre limit • Crushed rock construction entrance • Sandbags around and geotextile fabric over opening to lava tubes	• Sandbags and/or wire mesh gravel bags (gabions) that shall be made readily available on-site • Redefining and redigging swales to maintain capacity
2.	Soil as dust	Dry exposed ground at site	Hourly watering during dry days	
3.	Greenwaste	Clearing and grubbing operations	Daily site cleanup and removal of debris to off-site disposal location (dump)	

Table 2 (Continued)
Potential Pollutants, Sources and Mitigation Measures for the Ki'ilae Farms, South Kona, Hawai'i Project

	Potential Pollutant	Sources	Mitigation Measures	Contingency Plan
4.	Petroleum-based fluids & machinery discharge (hydraulic fluid, etc.)	Parked, stored and refueling construction equipment and vehicles	• Regular, daily maintenance – Removal of exterior oil and grease to avoid build-up and proper disposal off-site within 24 hours – Check for leaks – Avoidance of "topping-off" fluids to minimize chance of spills – Use of an off-site commercial washing business for washing down of equipment and vehicles; on-site washing down of equipment and vehicles shall be prohibited • Problems repaired within 24 hours • Drip pans and/or drop cloths (readily available on-site) under stored equipment during off-working times	• Adsorbent material (readily available on-site) for spills with prompt (within 24 hours) and proper disposal off-site along with contaminated soil and anything that comes in contact with pollutants • Avoidance of burying or hosing down leaks, spills and contaminated equipment and material

Table 2 (Continued)
Potential Pollutants, Sources and Mitigation Measures for the Ki'ilae Farms, South Kona, Hawai'i Project

	Potential Pollutant	Sources	Mitigation Measures	Contingency Plan
5.	Fertilizer, pesticide & herbicide	Storage at staging area	• Keeping in dry, covered storage • Adherence to manufacturer's directions and recommendations for storage and use • Use of only the minimum required amount and no more than the maximum allowable quantities. • Use only during dry, non-windy periods (check weather forecast); no application during periods of storms or rainfall	
6.	Dry cement	Storage at staging area	Keeping in dry, covered storage	

Main BMP efforts for the project shall include the following items:

1. Fill requirements shall be satisfied from excavation locations for the project roadway; no stockpiling of dirt shall be performed. No off-site dirt material shall be used. On-site soil is generally coarse, which will be reduced in size with a crusher at the contractor staging area for use as roadway aggregate. Crushed material will be stockpiled at the staging area. A silt fence shall be installed around the perimeter of the staging area to filter runoff.

2. A contractor staging area shall be established on the *makai* side of Hawai'i Belt Road either in the flat area adjacent to the existing HELCO substation or within the existing on-site cottage lot (refer to the plans for locations). This area shall be used for storage of equipment, vehicles, cement, sandbags, gabions (if used), geotextile material, drip pans and/or drop cloths, adsorbent material, fertilizer and pesticide. As mentioned in item 1 above, no dirt shall be stockpiled, only roadway aggregate. A silt fence shall be installed around the staging area. Security fencing around the perimeter of the staging area with gate and lock may be installed at the discretion of the contractor.

3. Storage sheds or purchased/fabricated covered (plywood, wood, plastic, etc.) structures shall be used to house fertilizer, pesticides, herbicides, cement and petroleum-based fluids for refueling and maintaining construction equipment and keep them dry. An inventory of stored chemicals and materials shall be kept. Fertilizer, pesticides and herbicides shall not be used during periods of rainfall to prevent undesired, chemical-laden runoff. Only the minimum required amounts and no more than the maximum allowable quantities shall be used.

4. Equipment and vehicles shall be maintained daily (check fluid levels, tire air pressure, seals and hoses for leaks, tightness of caps and plugs, etc.) to minimize the chance of discharge. Any problems shall be resolved within 24 hours. Drip pans and/or drop cloths shall be used beneath stored equipment and vehicles during off-working times. These pans and cloths shall be stored at the staging area (also the central refueling and maintenance station) and be readily available and accessible on-site. Adsorbent material should also be readily available on-site and be used immediately for spills or leaks. Spent adsorbent, contaminated soil, and any material in contact with the spill or lead shall be removed and disposed of promptly and properly from the site. Burying or hosing down spills or leaks shall not be allowed.

5. On-site washing down of equipment and vehicles shall not be allowed. Equipment and vehicles shall be washed down at an off-site commercial washing business.

6. Crushed rock construction entrances (#2 crushed rock 30′ wide × 50′ long × 12″ thick) shall be installed at the intersection of Hawai'i Belt Road and site access road "A" for phase 1, and along road "A" for each subsequent phase and entrance to the stockpile area. Refer to the plans for more detail.

7. All BMPs shall be installed and functioning properly prior to the commencement of construction work. See plans for more information and details.

8. Construction shall be sequenced in phases to limit the amount of ground opened up and cleared at a time. No more than 5 acres shall be worked on and exposed at a time. Clearing and grubbing shall be held to the minimum necessary for grading and equipment operations.

9. Areas to be exposed longer than a week shall be grassed, mulched or graveled. Permanent soil stabilization shall be accomplished with perennial vegetation or pavement after final grading.

10. Exposed areas shall be watered lightly hourly during dry conditions to control dust nuisance and transport into the ocean.

11. Silt fences shall be used for the entrance road work to filter runoff.

12. Interceptor swales/ditches shall be used along the subdivision roadways to direct runoff to sedimentation basins installed for each of the phases.

Interceptor swales shall also be constructed upslope of the proposed subdivision roadways in Phases 1, 2 and 5 to divert natural runoff away from project work and minimize the flow directed toward the sedimentation basins. Refer to the plans for more detail.

13. A gravel berm and silt fence shall be used along the *makai* edge of the Phase 5 sedimentation basin to filter runoff. Refer to the plans for more detail.

14. Existing inlets to lava tubes shall be completely surrounded by sandbags. Any openings to lava tubes encountered during construction work shall also be completely surrounded by sandbags. Should a lava tube opening be discovered during the construction of a sedimentation basin, and be located at the bottom of the basin, geotextile fabric shall be placed over the entire opening to the tube and sandbags shall be placed atop the fabric along the perimeter of the opening to act as both a filter for runoff and anchors for the fabric. Should the lava tube opening be located on the wall of the basin, geotextile fabric shall be placed over the entire opening and be anchored down with either sandbags or gravel. Refer to the plans for more detail.

15. The site will be designed to contain a 100-year storm event although County of Hawai'i standards require accommodation of a 50-year rainfall event.

16. The BMPs shall be monitored, inspected and maintained daily. Any damaged BMP shall be repaired within 24 hours. A BMP status report, including discussion on any revisions, shall be developed monthly and submitted to both the owner and DOH-CWB, Honolulu.

17. Baseline samples of nearshore coastal waters adjacent to the site will be taken for comparative purposes prior to the commencement of construction work. A rainfall gauge shall be installed at the roadway terminus prior to construction work commencement, and sampling of coastal waters shall be conducted after every rainfall period of 1″ or more within 24 hours for monitoring.

18. A photo log shall be maintained by the contractor, mainly of the coastal waters and construction site after 1″ rainfalls or greater. Photos shall be taken weekly regardless of weather conditions.

19. Sandbags (or gabions) can be used as a contingency measure in addition to regular erosion control measures for lava tubes. These items shall be used if needed, but are otherwise not required, as a mitigation measure to divert runoff. A sufficient quantity of sandbags shall be kept on-site and be readily available for both regular BMP and contingency applications. If gabions are used as a contingency measure, a sufficient quantity shall be readily available on-site.

20. A 4′×4′ sign shall be posted with the phone numbers for the DOH Honolulu Office Clean Water Branch—(808) 586-4309, after hours emergency reporting—(808) 247-2191, and on-site personnel.

21. Any questions or problems shall be directed to the CMI Group hotline (to be determined), DOH Honolulu Office CWB (808) 586-4309, or contractor (to be determined).

22. All BMP measures and improvements shall be in accordance with an archaeological monitoring plan approved by the State of Hawai'i, Department of Land and Natural Resources, Historic Preservation Division.

Best Management Practices are shown and detailed on Figures BMP-1 and BMP-2.

Site Runoff & Erosion

The overall drainage pattern of the site is not expected to change due to the project, both during and after construction. Runoff will generally surface flow westerly toward, but not reaching, Class AA-designated coastal waters just south of Ki'ilae Bay. The roadway terminus will be roughly 1,000 feet from the coastline with this middle area being flat and densely covered with vegetation, and the soil being coarse and porous. During construction, temporary BMPs, such as, interceptor swales and sedimentation basins, will prevent runoff and transported sediment from leaving the project site and reaching the ocean. After construction, drainage will be contained within the project site with roadside earthen swales and drywells, as shown in Drawings C-4 through C-17, C-62 and C-63.

Sedimentation Basins

The 1-hour rainfall intensity for the site is 2 inches for the 100-year storm. County of Hawai'i standards require sedimentation basins to be based on the 50-year storm; however, the sedimentation basins for the project were sized for the 100-year storm to be conservative. The ditches and sedimentation basins were sized to accommodate flow from the entire contributory area of each phase; however, project work for road construction will disturb only a small percentage of the total contributory area. Refer to Table 3 for a size comparison of the project-affected (disturbed) areas and the overall rainfall catchment areas within the site.

Table 3
Percentage of Actual Areal Disturbance for Each Construction Phase for the Ki'ilae Farms, South Kona, Hawai'i Project

Construction Phase	Total Contributory Area (Ac)	Area of Project Disturbance (Ac)	Percentage
Entrance Road & 1	12.57 Ac	4.20 Ac	33.41%
2	19.25 Ac	3.90 Ac	20.26%
3	24.04 Ac	4.15 Ac	17.26%
4	38.05 Ac	3.82 Ac	10.04%
5	8.94 Ac	3.56 Ac	39.82%

Table 4 summarizes the anticipated runoff within the site and the capacities of the sedimentation basins to be constructed and the existing natural basin that will accommodate this runoff. Since County of Hawai'i standards require sedimentation basins to be based on the 50-year storm, and the project sedimentation basins can accommodate 100-year storm runoffs, the basins are more than adequate to handle anticipated runoff within the entire project site. The constructed sedimentation basins all are square and 4′ deep with 8′ side slopes at 2:1 maximum banks. Refer to the appendix for calculations and plans for more detail.

Table 4
Runoff Quantities and Sedimentation Basin Capacities for the Ki'ilae Farms, South Kona, Hawai'i Project

Construction Phase	Catchment Area Runoff Rate (100-year Storm)	Sedimentation & Natural Basin Capacity
Entrance Road & 1	16.80 cfs	Natural Basin: 720,000 cf 180,000 sf × 4′ average depth
2	34.98 cfs	34,200 cf 100′×100′
3	39.88 cfs	41,900 cf 110′×110′
4	67.08 cfs	65,800 cf 136′×136′
5	14.42 cfs	15,700 cf 70′×70′

Erosion Soil Loss

Soil loss rates for the different construction conditions of the project phases are summarized in Table 5.

Table 5
Soil Loss Rates for Different Construction Conditions of the Ki'ilae Estates, South Kona, Hawai'i Project

Construction Phase	Soil Loss Rate (tons/[acre·year])				
	Existing Condition	Cleared & Grubbed Condition	Finished Graded & Landscaped Condition	Finished Condition	County of Hawai'i Maximum Allowable Rate
Entrance Road & 1	0.36	0.40	1.09	0.33	5.00
2	0.73	1.43	2.50	0.66	5.00
3	0.58	1.04	2.14	0.52	5.00
4	0.46	0.33	0.96	0.42	5.00
5	0.78	1.23	2.29	0.71	5.00

All anticipated soil loss rates for project construction are less than the maximum allowable rate of 5 tons/(acre·year) established by the County of Hawai'i. The existing annual soil loss rates for construction phase areas are all less than the estimated soil loss rates for the completed construction condition; thus, the project will improve the erosion characteristics of the site.

Since fill requirements balance cut volumes, no soil will be stockpiled and no off-site soil will be used, the anticipated eroded material at the site is that of the soils existing at the site—Rough Broken Land, Lava Flows—Pahoehoe and Punalu'u Extremely Rocky Peat USGS soil classifications, characterized by:

- Black peat;
- Stones;
- Rock;
- Gray vesicular basalt;
- Basaltic cobbles and gravel; and
- Red and brown mottling scoriaceaous basalt.

Erosion control measures to temporarily manage soil loss during construction include mulching, gravel berms, silt fences, crushed rock construction entrances, swales and sedimentation basins mentioned earlier. Soil loss will be controlled permanently by landscaping—grassing and grading.

Archaeological Monitoring

An archaeological survey of the entire project site was conducted in 2002 and the State of Hawaiʻi, Historic Preservation Division has documents of findings, correspondence and determinations of this survey in their files. A monitoring plan will be established throughout the duration of the project for historical properties and an archaeologist will be on-site during all working hours.

REFERENCES

1. *Best Management Practices Manual for Construction Sites in Honolulu*, Department of Environmental Services, City and County of Honolulu, May 1999.

2. *Geotechnical Engineering Exploration, Kiilae Estates Subdivision, TMK: 8-5-05: 19, 20, Portion 22, Honaunau, Island of Hawaii*, Geolabs, Inc., June 23, 2003.

3. *Hawaii County Code*, County of Hawai'i, State of Hawai'i, 1983, Revised & Republished 1995.

4. *Kiilae Estates, Erosion Control Report, TMKs: 8-5-05:19 & 22*, M & E Pacific, Inc., September 2003.

5. *Kiilae Farms, Drainage Report, TMKs: 8-5-05:19 & 22*, M & E Pacific, Inc., October 2003.

6. *Rainfall-Frequency Atlas of the Hawaiian Islands for Areas to 200 Square Miles, Durations to 24 Hours, and Return Periods from 1 to 100 Years*, Technical Paper 43, US Department of Commerce & Weather Bureau, 1962.

7. *Rules Relating to Storm Drainage Standards*, Department of Planning and Permitting, City and County of Honolulu, January 2000.

8. *Soil Survey of Island of Hawai'i*, State of Hawai'i, December 1973.

9. *Storm Drainage Standard*, Department of Public Works, County of Hawai'i, October 1970.

10. *Topographic Survey*, M & E Pacific, Inc., May 2003.

APPENDIX A

Calculations

Ki'ilae Estates LLC (CMI Development, Inc.)

Ki'ilae Farms Entrance Road Improvements & Subdivision Road Improvements

Purpose: These calculations are performed to determine adequate sizing of the sedimentation basins to be constructed as temporary erosion control measures at the Ki'ilae Farms project site. The basins are sized to accommodate estimated runoff quantities generated from a 100-year recurring storm. Since County of Hawai'i standards require BMP design to be based on 50-year rainfalls, the sedimentation basins are conservatively designed for an increased safety factor.

References:

1. *Best Management Practices Manual for Construction Sites in Honolulu* , Department of Environmental Services, City and County of Honolulu, May 1999.
2. *Rainfall-Frequency Atlas of the Hawaiian Islands for Areas to 200 Square Miles, Durations to 24 Hours, and Return Periods from 1 to 100 Years* , Technical Paper 43, US Department of Commerce & Weather Bureau, 1962.
3. *Rules Relating to Storm Drainage Standards* , Department of Planning and Permitting, City and County of Honolulu, January 2000.
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5. *Storm Drainage Standard* , Department of Public Works, County of Hawai'i, October 1970.
6. *Topographic Survey* , M & E Pacific, Inc., May 2003.

Criteria and Assumptions:

1. 100-year rainfall is 2″ per hour.
2. Area considered is total contributory area. Disturbed area is less than contributory area.
3. Design basins are square in plan view, 4′ deep and have 2H:1V bank side slopes.
4. The following table summarizes volumes for different top of bank basin lengths:

Top of Bank Length (feet)	Basin Volume (cubic feet)
70	15,632
82	22,160
100	34,112
110	41,872
136	65,792

5. Phase 1 drainage accommodated by natural basin roughly 720,000 cf in volume. Calculation of Phase 1 sedimentation basin volume were done to determine required equivalent design basin size and to confirm that the natural basin has adequate capacity.

C&C required sedimentation basin volume = WQDV (cf) = C × I × A × 3,630, (Reference 3, Page 45)

where C = runoff coefficient = 0.23
I = rainfall intensity in inches per hour = 2 (100-year storm)
A = Area in acres

Phase 1

$A = A_1 + A_{\text{Entrance Road}} = 12.17 + 0.40 = 12.57$ Ac

WQDV = (0.23) × (2″) × 12.57 acres × 3,630 = 20,989, say 21,000 cf.

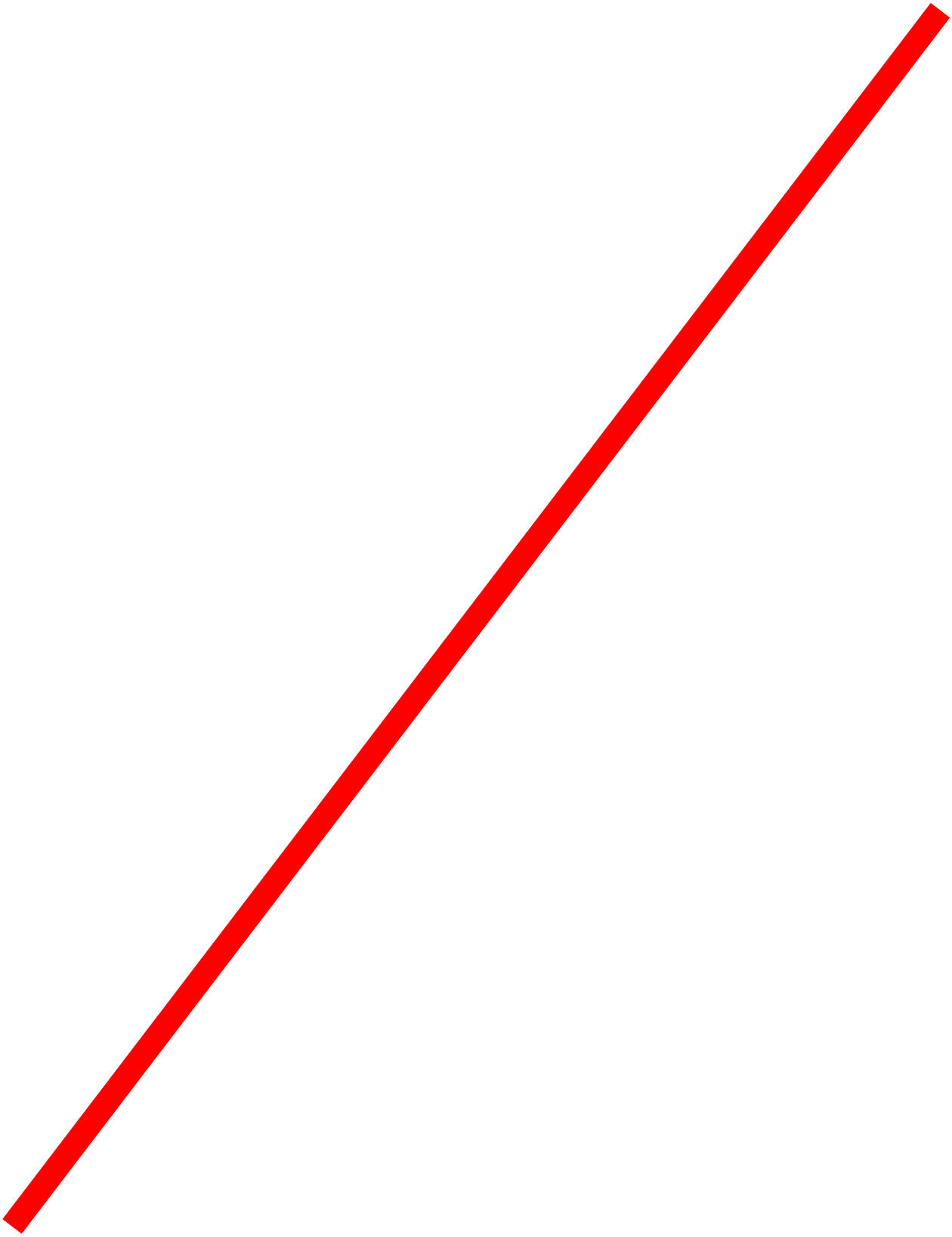
Using a basin with side slopes of 2H:1V and a depth of 4′, the design top-of-bank size is **82′ × 82′**.

Phase 2

$A = A_2 = 19.25$ Ac

WQDV = (0.23) × (2″) × 19.25 acres × 3,630 = 32,144, say 33,000 cf.

Using a basin with side slopes of 2H:1V and a depth of 4′, the design top-of-bank size is **100′ × 100′**.



Phase 3

A = A_3 = 24.04 Ac
WQDV = (0.23) × (2″) × 24.04 acres × 3,630 = 40,142, say 41,000 cf.
Using a basin with side slopes of 2H:1V and a depth of 4′, the design top-of-bank size is **110′ × 110′**.

Phase 4

A = A_4 = 38.05 Ac
WQDV = (0.23) × (2″) × 38.05 acres × 3,630 = 63,536, say 64,000 cf.
Using a basin with side slopes of 2H:1V and a depth of 4′, the design top-of-bank size is **136′ × 136′**.

Phase 5

A = A_5 = 8.94 Ac
WQDV = (0.23) × (2″) × 8.94 acres × 3,630 = 14,928, say 15,000 cf.
Using a basin with side slopes of 2H:1V and a depth of 4′, the design top-of-bank size is **70′ × 70′**.

APPENDIX B

BMP Details

BEST MANAGEMENT PRACTICES MANUAL
FOR
CONSTRUCTION SITES IN HONOLULU

Prepared by the

Department of Environmental Services
City and County of Honolulu

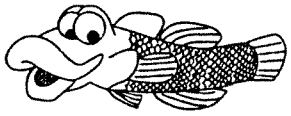
in cooperation with

The General Contractors Association of Hawaii

May 1999

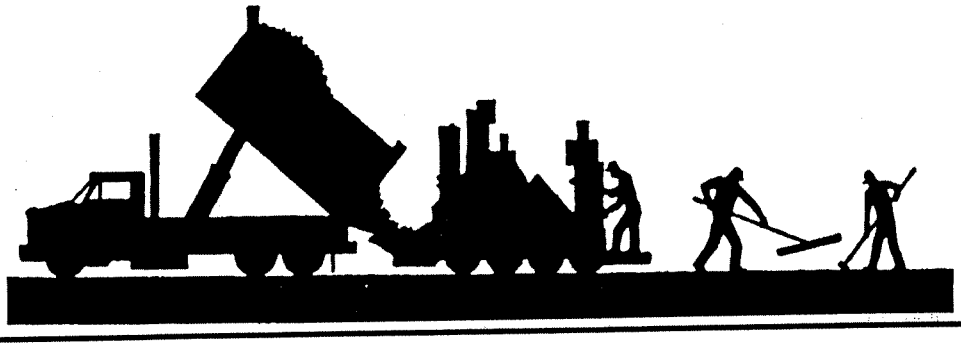
Second Printing
November 2000

Help protect our waters ... for life!



ACTIVITY: PAVING OPERATIONS

Graphic: North Central Texas COG, 1993



DESCRIPTION

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runon and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

APPROACH

- Avoid paving during wet weather.
- *Use asphalt emulsions as prime coat where possible.*
- Store materials away from drainage courses to prevent storm water runon (see CA10 Material Delivery and Storage).
- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or trap/filter sediment (see Chapter 5).
- Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials rather than burying. See CA32 (Vehicle and Equipment Maintenance) and CA12 (Spill Prevention and Control) in this chapter.
- *Block/protect* catch basins and *cover* manholes when applying seal coat, tack coat, slurry seal, fog seal, etc.
- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.
- If paving involves portland cement concrete, see CA23 (Concrete Waste Management) in this chapter.
- If paving involves asphaltic concrete, follow these steps:
  - Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or *streams* by sweeping. Properly dispose of this waste by referring to CA20 (Solid Waste Management) in this chapter.
  - Old asphalt must be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.
  - If paving involves on-site mixing plant, follow the storm water permitting requirements for industrial activities.
- Train employees and subcontractors.

REQUIREMENTS

- Costs (Capital, O&M)
  - All of the above are low cost measures.
- Maintenance
  - Inspect employees and subcontractors to ensure that measures are being followed.
  - Keep ample supplies of drip pans or absorbent materials on-site.

LIMITATIONS

- There are no major limitations to this best management practice

Objectives

- Housekeeping Practices
- Contain Waste
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

Targeted Pollutants

- ◒ Sediment
- ○ Nutrients
- ◒ Toxic Materials
- ◒ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Waste

- ● Likely to Have Significant Impact
- ○ Probable Low or Unknown Impact

Implementation Requirements

- ○ Capital Costs
- ○ O&M Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

● High ○ Low

CA2

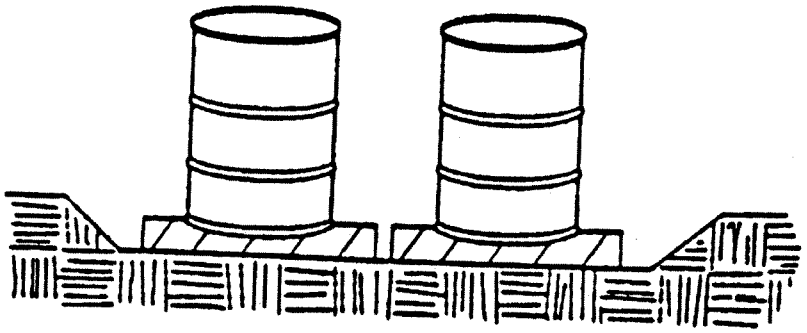
BEST MANAGEMENT PRACTICES

REFERENCES

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

Hot-mix Asphalt Paving Handbook. U.S. Army Corps of Engineers, AC 150/5370-14, Appendix 1, July 1991.

ACTIVITY: MATERIAL DELIVERY AND STORAGE



DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from material delivery and storage by minimizing the storage of hazardous materials on-site, storing materials in a designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see CA11 (Material Use), or CA12 (Spill Prevention and Control). For information on wastes, see the waste management BMPs in this chapter.

APPROACH

The following materials are commonly stored on construction sites:

- Soil,
- Pesticides and herbicides,
- Fertilizers,
- Detergents,
- Plaster or other products,
- Petroleum products such as fuel, oil, and grease, and
- Other hazardous chemicals such as acids, lime, glues, paints, solvents, and curing compounds.

Storage of these materials on-site can pose the following risks:

- Storm water pollution,
- Injury to workers or visitors,
- Groundwater pollution, and
- Soil contamination.

Therefore, the following steps should be taken to minimize your risk:

- Designate areas of the construction site for material delivery and storage.
  - Place near the construction entrances, away from waterways
  - Avoid transport near drainage paths or waterways
  - Surround with earth berms (see ESC30, Earth Dike) *or approved containment device.*
  - Place in an area which *is* paved.
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- For a quick reference on disposal alternatives for specific wastes, see Table 1.2 and CA40, Employee/Subcontractor Training.
- Keep an accurate, up-to-date inventory of materials delivered and stored on-site.
- Keep your inventory down.
- *Maintain a complete set of material safety data sheets at the project site.*

Objectives

- *Housekeeping Practices*
- *Contain Waste*
- *Minimize Disturbed Areas*
- *Stabilize Disturbed Areas*
- *Protect Slopes/Channels*
- *Control Site Perimeter*
- *Control Internal Erosion*

Targeted Pollutants

- ◒ *Sediment*
- ◒ *Nutrients*
- ◒ *Toxic Materials*
- ◒ *Oil & Grease*
- ◒ *Floatable Materials*
- ○ *Other Construction Waste*

- ● *Likely to Have Significant Impact*
- ○ *Probable Low or Unknown Impact*

Implementation Requirements

- ○ *Capital Costs*
- ○ *O&M Costs*
- ○ *Maintenance*
- ◒ *Training*
- ○ *Suitability for Slopes >5%*

● *High* ○ *Low*

CA10

BEST MANAGEMENT PRACTICES

- Minimize hazardous materials on-site storage.
- Handle hazardous materials as infrequently as possible.
- During the rainy season, consider storing materials in a covered area. Store materials in secondary containments such as an earthen dike, horse trough; or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, in secondary containment.
- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids and to reduce corrosion.
- Try to keep chemicals in their original containers, and keep them well labeled.
- Train employees and subcontractors.
- Employees trained in emergency spill cleanup procedures should be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove materials and any contaminated soil (See CA22). If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

REQUIREMENTS

- Cost (Capital, O&M)
  - All of the above are low cost measures.
- Maintenance
  - Keep the designated storage area clean and well organized.
  - Conduct routine weekly inspections and check for external corrosion of material containers.
  - Keep an ample supply of spill cleanup materials near the storage area.

LIMITATIONS

- Storage sheds often must meet building and fire code requirements.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites; Flood Control District of Maricopa County, AZ, September 1992.

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

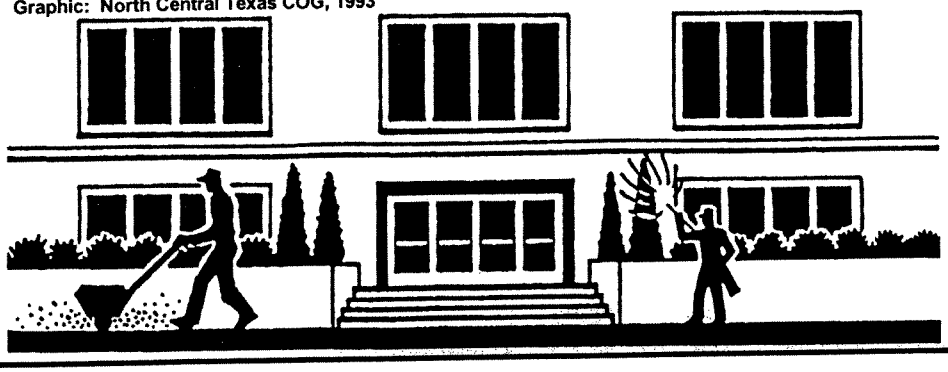
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Storm Water Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

CA10

ACTIVITY: MATERIAL USE

Graphic: North Central Texas COG, 1993



DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from material use by using alternative products, minimizing hazardous material use on-site, and training employees and subcontractors.

APPROACH

The following materials are commonly used on construction sites:

- Pesticides and herbicides,
- Fertilizers,
- Detergents,
- Plaster and other products,
- Petroleum products such as fuel, oil, and grease, and
- Other hazardous chemicals such as acids, lime, glues, paints, solvents, and curing compounds.

Use of these materials on-site can pose the following risks:

- Storm water pollution,
- Injury to workers or visitors,
- Groundwater pollution, and
- Soil contamination.

Therefore, the following steps should be taken to minimize your risk:

- Use less hazardous, alternative materials as much as possible.
- Minimize use of hazardous materials on-site.
- Use materials only where and when needed to complete the construction activity.
- Follow manufacturer's instructions regarding uses, protective equipment, ventilation, flammability, and mixing of chemicals.
- Personnel who use pesticides should be trained in their use. The *State Department of Agriculture, Pesticides Branch*, licenses pesticide dealers, certifies pesticide applicators, and conducts on-site inspections.
- Do not over-apply fertilizers, herbicides, and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydroseeding. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains.
- Train employees and subcontractors in proper material use.

Objectives

- *Housekeeping Practices*
- *Contain Waste*
- *Minimize Disturbed Areas*
- *Stabilize Disturbed Areas*
- *Protect Slopes/Channels*
- *Control Site Perimeter*
- *Control Internal Erosion*

Targeted Pollutants

- ○ *Sediment*
- ◒ *Nutrients*
- ◒ *Toxic Materials*
- ◒ *Oil & Grease*
- ◒ *Floatable Materials*
- ○ *Other Construction Waste*

- ● *Likely to Have Significant Impact*
- ○ *Probable Low or Unknown Impact*

Implementation Requirements

- ○ *Capital Costs*
- ○ *O&M Costs*
- ○ *Maintenance*
- ◒ *Training*
- ○ *Suitability for Slopes >5%*

● *High* ○ *Low*

CA11

BEST MANAGEMENT PRACTICES

REQUIREMENTS
- Costs (Capital, O&M)
  - All of the above are low cost measures.
- Maintenance
  - Maintenance of this best management practice is minimal.

LIMITATIONS
- Alternative materials may not be available, suitable, or effective in every case.

REFERENCES

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992; Santa Clara Valley Nonpoint Source, Pollution Control Program, 1992.

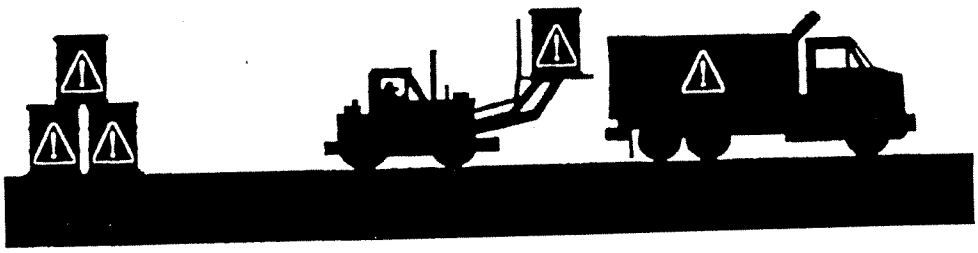
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Storm Water Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

CA11

ACTIVITY: HAZARDOUS WASTE MANAGEMENT

Graphic: North Central Texas COG, 1993



Objectives

- Housekeeping Practices
- **Contain Waste**
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water *and to the land* from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

APPROACH

Many of the chemicals used on-site can be hazardous materials which become hazardous waste upon disposal. These wastes may include:

- Paints and solvents;
- Petroleum products such as oils, fuels, and grease;
- Herbicides and pesticides;
- Acids for cleaning masonry; and
- Concrete curing compounds.
- *C&D wastes, including clean-up materials, contaminated with hazardous substances (for more information on C&D wastes, see CA20 Solid Waste Management).*

In addition, sites with existing structures may contain wastes which must be disposed of in accordance with Federal, State, and local regulations. These wastes include:

- Sandblasting grit *or chips contaminated* with lead, cadmium, or chromium-based paints;
- Asbestos; and
- PCBs (particularly in older transformers).

To determine if a material or item is potentially hazardous waste:

- *Check label and shipping papers.*
- *Look for words such as hazardous, danger, caustic or corrosive (dissolves skin, metal or other materials); flammable or ignitable (catches fire easily); carcinogenic (causes cancer); and toxic or poisonous (harms people and animals.) A list of hazardous waste and criteria are found in Hawaii Administrative Rules (HAR) Title 11, Chapter 261.*
- *Check the material safety data sheet (MSDS) the manufacturer must prepare for the product. Ask your supplier for a copy.*
- *For questions and additional information including fact sheets and flyers, call the DOH, Hazardous Waste Program Office at 586-4225.*

Targeted Pollutants

- ○ Sediment
- ○ Nutrients
- ◒ Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Waste

- ● Likely to Have Significant Impact
- ○ Probable Low or Unknown Impact

Implementation Requirements

- ○ Capital Costs
- ○ O&M Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

● High ○ Low

CA21

BEST MANAGEMENT PRACTICES

ACTIVITY: HAZARDOUS WASTE MANAGEMENT (Continue)

The following steps will help reduce storm water *and land* pollution *concerns resulting* from hazardous wastes:

Material Use

- Use all of the product before disposing of the container.
- Do not remove the original product label, it contains important safety and disposal information.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with Federal and State regulations.
- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and re-use thinners and solvents. Dispose of excess oil based paints and sludge as hazardous waste.
- *Consult the "Hazardous Waste Management Checklist" within the State DBEDT's "A Contractor's Waste Management Guide: Best Management Practices and Tools for Job Site Recycling and Waste Reduction in Hawaii" for additional tips and BMPs on selecting and purchasing lesser-toxic building products.*

The DBEDT manual also offers detailed, helpful tips on solid waste management (see CA20) and a "General Practices Checklist" for training subcontractors and employees how to maximize opportunities for on-site waste reduction and recycling. For a free copy of the guide, contact DBEDT at 587-3802.

Waste Recycling/Disposal

- Select designated hazardous waste collection areas on-site.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, make recycling impossible, and complicate disposal.
- Recycle any useful material such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g. excess oil-based paint and sludges) is collected, removed, and disposed of only at authorized disposal areas.
- For a quick reference on disposal alternatives for specific wastes, see Table 1.2 and CA40, Employee/Subcontractor Training.
- *Consult the "Hazardous Waste Management Checklist" within the State DBEDT's "A Contractor's Waste Management Guide: Best Management Practices and Tools for Job Site Recycling and Waste Reduction in Hawaii" for additional tips and BMPs on how to reduce hazardous waste volumes, and how to best determine if a material or item is a potentially hazardous waste.*

Training

- Train employees and subcontractors in proper hazardous waste management. *Consult the "Hazardous Waste Management Checklist" within the State DBEDT's "A Contractor's Waste Management Guide: Best Management Practices and Tools for Job Site Recycling and Waste Reduction in Hawaii" for tips and other useful resources available to help you train employees and subcontractors.*
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

REQUIREMENTS

- Costs (Capital, O&M)
  - All of the above are low cost measures.
- Maintenance
  - Inspect hazardous waste receptacles and area regularly.
  - Arrange for regular hazardous waste collection.

CA21

LIMITATIONS

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.

REFERENCES

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

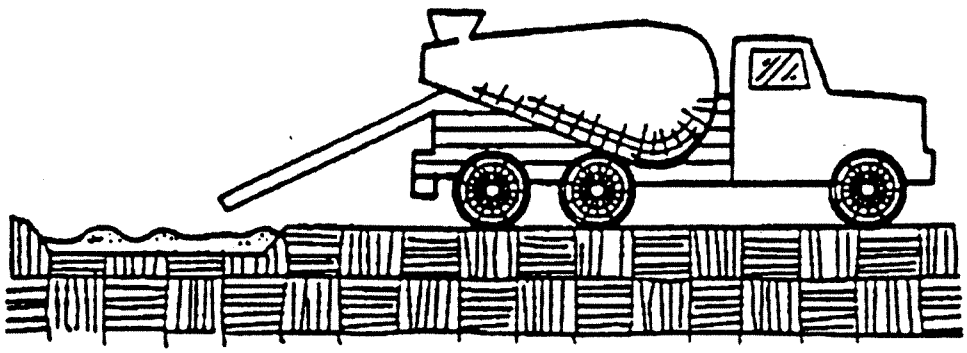
Processes, Procedures, and Methods to Control Pollution Resulting from all Construction Activity; USEPA, 430/9-73-007, 1973.

A Contractor's Waste Management Guide: Best Management Practices and Tools for Job Site Recycling and Waste Reduction in Hawaii, DBEDT, January, 1999.

Minimizing Construction and Demolition Waste: A C&D Waste Management Guide, First Edition, DOH, February, 1998.

CA21

ACTIVITY: CONCRETE WASTE MANAGEMENT



Objectives

- Housekeeping Practices
- **Contain Waste**
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from concrete waste by conducting washout off-site, performing on-site washout in a designated area, and training employees and subcontractors.

APPROACH

The following steps will help reduce storm water pollution from concrete wastes:

- Store dry and wet materials under cover, away from drainage areas.
- Avoid mixing excess amounts of fresh concrete or cement on-site.
- Perform washout of concrete trucks off site or in designated areas only.
- Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped on-site, except in designated areas.
- For on-site washout:
  - locate washout area at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste;
  - wash out wastes into the temporary pit where the concrete can set, be broken up, and then disposed of properly.
- When washing concrete to remove fine particles and expose the aggregate, avoid creating runoff by draining the water to a bermed or level area.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stock pile, or dispose in the trash.
- Train employees and subcontractors in proper concrete waste management.
- For a quick reference on disposal alternatives for specific wastes, see Table 1.2 and CA40, Employee/Subcontractor Training.

REQUIREMENTS

- Costs (Capital, O&M)
  - All of the above are low cost measures.
- Maintenance
  - Inspect subcontractors to ensure that concrete wastes are being properly managed.
  - If using a temporary pit, dispose hardened concrete on a regular basis.

LIMITATIONS

- Off-site washout of concrete wastes may not always be possible.

Targeted Pollutants

- ○ Sediment
- ○ Nutrients
- ○ Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ◒ Other Construction Waste

- ● Likely to Have Significant Impact
- ○ Probable Low or Unknown Impact

Implementation Requirements

- ○ Capital Costs
- ○ O&M Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

● High ○ Low

CA23

BEST MANAGEMENT PRACTICES

REFERENCES

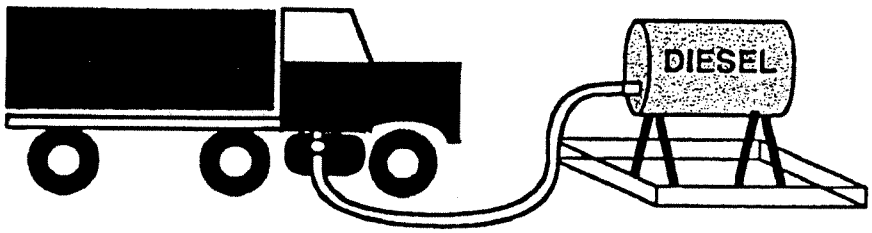
Best Management Practices and Erosion Control Manual for' Construction Sites; Flood Control District of Maricopa County, AZ, July 1992.

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

Storm Water Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

CA23

ACTIVITY: VEHICLE AND EQUIPMENT FUELING



Objectives

- Housekeeping Practices
- Contain Waste
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

DESCRIPTION

Prevent fuel spills and leaks, and reduce their impacts to storm water by using off-site facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors.

APPROACH

- Use off-site fueling stations as much as possible. Fueling vehicles and equipment outdoors or in areas where fuel may spill/leak onto paved surfaces or into drainage pathways can pollute storm water. If you fuel a large number of vehicles or pieces of equipment, consider using an off-site fueling station. These businesses are better equipped to handle fuel and spills properly. Performing this work off-site can also be economical by eliminating the need for a separate fueling area at your site.
- If fueling must occur on-site, use designated areas, located away from drainage courses, to prevent the runon of storm water and the runoff of spills.
- Discourage "topping-off of fuel tanks.
- Always use secondary containment, such as a drain pan or drop cloth, when fueling to catch spills/leaks.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
- Carry out all Federal and State requirements regarding stationary above ground storage tanks.
- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and perhaps forklifts, most vehicles should be able to travel to a designated area with little lost time.
- Train employees and subcontractors in proper fueling and cleanup procedures.
- For a quick reference on disposal alternatives for specific wastes, see Table 1.2 and CA40, Employee/Subcontractor Training.

REQUIREMENTS

- Costs (Capital, O&M)
  - All of the above measures are low cost, except for the capital costs of above ground tanks that meet all local environmental, zoning, and fire codes.
- Maintenance
  - Keep ample supplies of spill cleanup materials on-site.
  - Inspect fueling areas and storage tanks on a regular schedule.

LIMITATIONS

- Sending vehicles/equipment off-site should be done in conjunction with ESC24 (Stabilized Construction Entrance)

Targeted Pollutants

- ○ Sediment
- ○ Nutrients
- ◒ Toxic Materials
- ◒ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Waste

- ● Likely to Have Significant Impact
- ○ Probable Low or Unknown Impact

Implementation Requirements

- ◒ Capital Costs
- ○ O&M Costs
- ◒ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

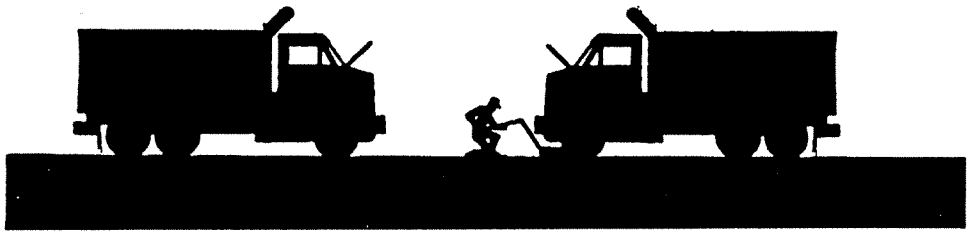
● High ○ Low

CA31

BEST MANAGEMENT PRACTICES

ACTIVITY: VEHICLE AND EQUIPMENT MAINTENANCE

Graphic: North Central Texas COG, 1993



Objectives

- Housekeeping Practices
- Contain Waste
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from vehicle and equipment maintenance by running a "dry site". This involves using off-site facilities, performing work in designated areas only, providing cover for materials stored outside, checking for leaks and spills, containing and cleaning up spills immediately, and training employees and subcontractors.

APPROACH

- Keep vehicles and equipment clean, don't allow excessive build-up of oil and grease.
- Use off-site repair shops as much as possible. Maintaining vehicles and equipment outdoors or in areas where vehicle or equipment fluids may spill or leak onto the ground can pollute stormwater. If you maintain a large number of vehicles or pieces of equipment, consider using an off-site repair shop. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work off-site can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must occur on-site, use designated areas, located away from drainage courses, to prevent the runon of storm water and the runoff of spills.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
- Regularly inspect on-site vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment on-site.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic, and transmission fluids.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.
- For a quick reference on disposal alternatives for specific wastes, see Table 1.2 and CA40, Employee/Subcontractor Training.

REQUIRMENTS

- Costs (Capital, O&M
  - All of the above are low cost measures.
- Maintenance
  - Keep ample supplies of spill cleanup materials on-site.
  - Inspect maintenance areas on a regular schedule.

Targeted Pollutants

- ○ Sediment
- ○ Nutrients
- ◒ Toxic Materials
- ◒ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Waste

- ● Likely to Have Significant Impact
- ○ Probable Low or Unknown Impact

Implementation Requirements

- ○ Capital Costs
- ○ O&M Costs
- ○ Maintenance
- ◒ Training
- ○ Suitability for Slopes >5%

● High ○ Low

CA32

BEST MANAGEMENT PRACTICES

LIMITATIONS
- Sending vehicles/equipment off-site should be done in conjunction with ESC24 (Stabilized Construction Entrance).

Outdoor vehicle or equipment maintenance is a potentially significant source of storm water pollution. Activities that can contaminate storm water include engine repair and service, particularly changing or replacement of fluids, and outdoor equipment storage and parking (dripping engines). For further information on vehicle or equipment servicing, see CA30, Vehicle and Equipment Cleaning, and CA31, Vehicle and Equipment Fueling.

Listed below is further information if you must perform vehicle or equipment maintenance on-site.

Waste Reduction

Parts are often cleaned using solvents such as trichloroethylene, 1,1,1-trichloroethane, or methylene chloride. Many of these parts cleaners are harmful and must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents (1,1,1-trichloroethane, methylene chloride, etc.) with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic end less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents. The "chlor" term indicates that the solvent is chlorinated. Also, try substituting a wire brush for solvents to clean parts.

Recycling/Disposal

Separating wastes allows for easier recycling and may reduce disposal costs. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents (like 1,1,1-trichloroethane) separate from nonchlorinated solvents (like kerosene and mineral spirits). Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.

Oil filters disposed of in trash cans or dumpsters can leak oil and contaminate storm water. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

Do not dispose of extra paints and coatings by dumping liquid onto the ground or throwing it into dumpsters. Allow coatings to dry or harden before disposal into covered dumpsters.

Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Do not bury used tires.

REFERENCES

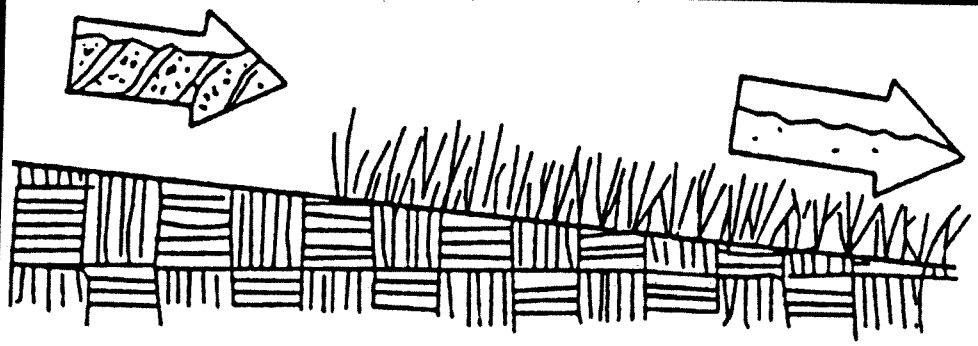
Best Management Practices and Erosion Control Manual for Construction Sites; Flood Control District of Maricopa County, AZ, September 1992.

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

CA32

BMP: SEEDING AND PLANTING



Objectives

- Housekeeping Practices
- Contain Waste
- Minimize Disturbed Areas
- **Stabilize Disturbed Areas**
- **Protect Slopes/Channels**
- Control Site Perimeter
- Control Internal Erosion

GENERAL DESCRIPTION

Seeding of grasses and plantings of trees, shrubs, vines and ground covers provide longterm stabilization of soil. In some areas, with suitable climates, grasses can be planted for temporary stabilization.

SUITABLE APPLICATIONS

- Appropriate for site stabilization both during construction and post-construction.
- Any graded/cleared areas where construction activities have ceased.
- Open space cut and fill areas.
- Steep slopes.
- Spoil piles.
- Vegetated swales.
- Landscape corridors.
- Stream banks.

INSTALLATION/APPLICATION CRITERIA

Type of vegetation, site and seedbed preparation, planting time, fertilization and water requirements should be considered for each application.

Grasses:

- Ground preparation: fertilize and mechanically stabilize the soil.
- Tolerant of short-term temperature extremes and waterlogged soil conditions.
- Appropriate soil conditions: shallow soil base, good drainage, slope 2:1 or flatter.
- Develop well and quickly from seeds.
- Mowing, irrigating, and fertilizing are vital for promoting vigorous grass, growth.

Trees and Shrubs:

- Selection Criteria: vigor, species, size, shape & wildlife food source.
- Soil conditions: select species appropriate for soil, drainage & acidity.
- Other Factors: wind/exposure, and irrigation needs.

Vines and Ground Covers:

- Ground preparation: lime and fertilizer preparation.
- Use proper seeding rates.
- Appropriate soil conditions: drainage, acidity, slopes.
- Generally avoid species requiring irrigation.

Targeted Pollutants

- ● Sediment
- ◒ Nutrients
- ◒ Toxic Materials
- ○ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Waste

- ● Likely to Have Significant Impact
- ○ Probable Low or Unknown Impact

Implementation Requirements

- ◒ Capital Costs
- ◒ O&M Costs
- ◒ Maintenance
- ◒ Training
- ◒ Suitability for Slopes >5%

● High ○ Low

ESC10

BEST MANAGEMENT PRACTICES

REQUIREMENTS

- Maintenance
  - Shrubs and trees must be adequately watered and fertilized and if needed pruned.
  - Grasses may need to be watered and mowed.
- Cost: Average annual cost for installation and maintenance (2- year useful life, source: EPA, 1992)
  - Seeding: $300 per acre, appropriate for flat slopes and stable soils.
  - Seeding with Mulching: $1,100 per acre, appropriate for moderate to steep slopes and/or erosive soils.
  - Trees, shrubs, vines, and ground cover: Cost, applicability based on species used and terrain features.

LIMITATIONS

- Permanent and temporary vegetation may not be appropriate in dry periods without irrigation.
- Fertilizer requirements may have potential to create storm water pollution if improperly applied.

ESC10

ADDITIONAL INFORMATION: SEEDING AND PLANTING

Permanent seeding of grasses, sodding, and planting of trees, shrubs, vines and ground covers can provide long-term stabilization of soil. Permanent seeding and planting contributes to long-term site aesthetics and helps reduce erosion by reducing the velocity of runoff, allowing infiltration to occur, filtering sediments, and by holding soil particles in place.

Seeding and planting should be applied as soon as final grading is done to all graded and cleared areas of the construction site where plant cover is ultimately desired. For example, vegetation may be established along landscaped corridors and buffer zones where they may act as filter strips (see TC6 in Chapter 5 of the *California* Municipal *BMP* Handbook). Additionally, vegetated swales, steep *and/or* arid/or rocky slopes and stream banks can also serve as appropriate areas for seeding and plantings.

Installation/Application Criteria

Application of appropriate vegetation must consider: the seedbed or plantbed, proper seasonal planting times, water requirements fertilizer requirements and availability of the selected vegetation within the project's region. Permanent plantings during the construction stage of projects require careful coordination between the local agency inspectors, project managers, construction managers, and landscape contractor. Protocols for coordination and implementation procedures regarding site access, construction staging, and short- and long-term planting areas should be developed prior to the construction bid process. Where possible, these protocols should be established by and remain the responsibility of the site owner.

Because of the many available types of plants and ground covers and because site conditions and land use vary so widely, a set of general guidelines is included for installation/application of grasses, trees and shrubs, vines and ground covers. However, the National Resources Conservation Service (NRCS), agricultural extension or other resources should be consulted on appropriate species, planting requirements, and maintenance needs for your climate and soils.

Grasses

Grasses, depending on the type, provide short-term soil stabilization during construction or can serve as long- term/ permanent soil stabilization for disturbed areas. In general, grasses provide low maintenance to areas that have been cleared, graded and mechanically stabilized.

Selection:

The selection of the grass type is determined by the climate, irrigation, mowing frequency, maintenance effort and soilbed conditions. Although grasses provide quick germination and rapid growth, they also have a shallow root system and are not as effective in stabilizing deep soils, where trees, shrubs and deep rooted ground covers may be more appropriate. Specific seed mix and/or varieties for each site should be provided by an approved/qualified plant materials specialist.

ESC10

ADDITIONAL INFORMATION: SEEDING AND PLANTING

Planting:
The following steps should be followed to ensure established growth:

1. Select the proper grass for the site.
2. Prepare the seedbed; soil should be fertilized and contain good topsoil or soil at least a 2:1 or flatter slope.
3. Initial irrigation will be required often for most grasses, with follow-up irrigation and fertilization as needed. Mulching may be required in dry climates or during drought years.

Trees & Shrubs

Selection:
Trees and shrubs, when properly selected, are low maintenance plantings that stabilize adjacent soils, moderate the adjacent temperatures, filter air pollutants, and serve as a barrier to wind. Some desirable characteristics to consider in selecting trees and shrubs include: vigor, species, age, size and shape, and use as a wildlife food source and habitat.

Trees and shrubs to be saved should be clearly marked so that no construction activity will take place within the dripline of the plant. The sites for new plantings should be evaluated. Consider the prior use of the land: adverse soil conditions such as poor drainage or acidity; exposure to wind; temperature extremes; location of utilities, paved areas, and security lighting and traffic problems.

Transplanting:
Preparation - Proper digging of a tree/shrub includes the conservation of as much of the root system as possible. Soil adhering to the roots should be damp when the tree is dug, and kept moist until re-planting. The soil ball should be 12 inches in diameter for each inch of diameter of the trunk.

Site preparation - Refer to landscape plans and specifications for site and soil preparation, and for ability to coordinate construction strategy with permanent vegetation.

Supporting the trunk - Many newly planted trees/shrubs need artificial support to prevent excessive swaying.

Watering - Soil around the tree should be thoroughly watered after the tree is set in place. When the soil becomes dry, the tree should be watered deeply, but not often. Mulching around the base of the tree is helpful in preventing roots from drying out.

Vines & Ground Covers

Selection:
Vines, ground covers, and low growing plants, that can quickly spread, come in many types, colors, and growth habits. Some are suitable only as part of a small maintained landscape area, while some can stabilize large areas with little maintenance. Flowers, which provide little long-term erosion control may be planted to add color and varietal appearances.

ESC10

ADDITIONAL INFORMATION: SEEDING AND PLANTING

Caution should be exercised in the non-native vegetation because of impacts to native vegetation on adjacent lands. For example, species that may be planted at the construction site can quickly spread and compete with originally undisturbed vegetation. In addition to stabilizing disturbed soil, vines and ground covers can perform the following functions:

1. Provide attractive cover that does not need mowing.
2. Help to define traffic areas and control pedestrian movement.

Site Preparation:
Ground covers are plants that naturally grow very close together, causing severe competition for space nutrients and water. Sod for ground covers should be well prepared. The entire area should be spaded, disced, or rototilled to a depth of six to eight inches. Two to three inches of organic material, such as good topsoil or peat, should be spread over the entire area.

Planting:
The following steps will help ensure good plant growth.

1. Make the plantings following the contours of the land.
2. Dig the holes 1/3 larger than the plant root ball.
3. Know what depth to place the plants.
4. Use good topsoil or soil mixture with a lot of organic matter.
5. Fill hole 1/3 to 1/2 full, shake plants to settle soil among roots, then water.
6. Leave saucer-shaped depression around the plant to hold water.
7. Water thoroughly and regularly.
8. Space plants according to the type of plant and the extent of covering desired.

Materials:
There are many different species of vines and ground covers from which to choose, but care must be taken in their selection. It is essential to select planting materials suited to both the intended use and specific site characteristics. Additional information can be obtained from local nurserymen, landscape architects, and extension agents. An approved low water use plant list may be obtained from the *Board of Water Supply (BWS)*, or Natural Resources Conservation Service.

Requirements
Maintenance

General requirements include:
- Grass maintenance should be minimal to none. Irrigation and regular fertilizing may be required for some types of grasses. Mowing is only required in areas where aesthetics or fire hazards are a concern.
- Young trees should receive an inch of water each week for the first two years after planting. The tree should be watered deeply, but not more often than once per week
- Transplanted trees, should be fertilized on an annual basis.
- Proper pruning, watering, and application of fertilizer is necessary to maintain healthy and vigorous shrubs. A heavy layer of mulch applied around the shrubs reduces weeds and retains moisture.
- Trim old growth as needed to improve the appearance of ground covers. Most covers need once-trimming to promote growth.

ESC10

ADDITIONAL INFORMATION: SEEDING AND PLANTING

Limitations

- Construction activities are likely to injure or kill trees unless adequate protective measures are taken. Direct contact by equipment is the most obvious problem, but damage is also caused by root stress from filling, excavation, or compacting too close to trees.
- Temporary seeding can only be viable when adequate time is available for plants to grow and establish.
- Over fertilizing of plants may cause pollution of storm water runoff.
- Irrigation source and supply may be limiting.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, September 1992.

"Draft - Sedimentation and Erosion Control, An Inventory of Current Practices", U.S.E.P.A., April, 1990.

Guides for Erosion and Sediment Controls in California, USDA Soils Conservation Service - January 1991.

Kiowa Engineering, Interim Erosion and Sedimentation Control for Construction Activities, Urban Drainage and Flood Control District, Denver, Colorado.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, Jun 1981.

Proposed Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters, Work Group Working Paper, USEPA, April, 1992.

Stormwater Management Water for the Puget Sound Basin, Washington State Department of Ecology, The Technical Manual - February 1992, Publication # 91-75.

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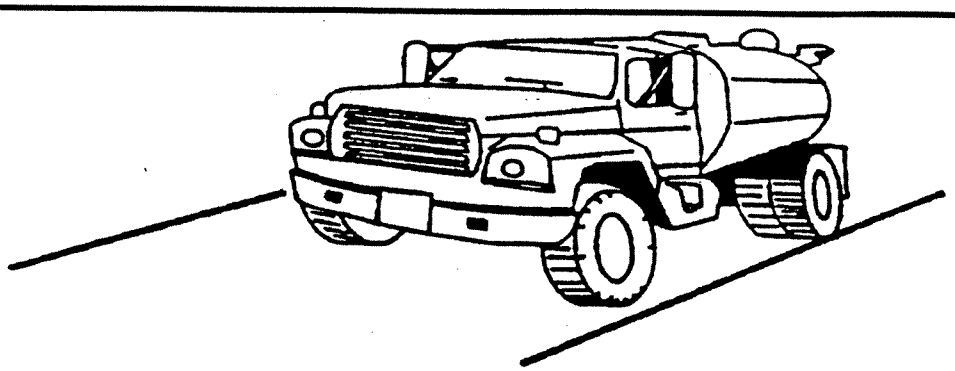
ESC10

BMP: DUST CONTROLS



Objectives

- Housekeeping Practices
- Contain Waste
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

GENERAL DESCRIPTION

Dust control measures are used to stabilize soil from wind erosion, and reduce dust generated by construction activities.

SUITABLE APPLICATIONS

- Clearing and grading activities.
- Construction vehicle traffic on unpaved roads.
- Drilling and blasting activities.
- Sediment tracking onto paved roads.
- Soil and debris storage piles.
- Batch drop from front end loaders.
- Areas with unstabilized soil.
- Final grading/site stabilization usually is sufficient to control post-construction dust sources.

INSTALLATION/APPLICATION CRITERIA

- Schedule construction activities to minimize exposed area (See ESC1).
- Quickly stabilize exposed soils using vegetation, mulching, spray-on adhesives, calcium chloride, sprinkling, and stone/gravel layering (See ESC10 and 11).
- Identify and stabilize key access points prior to commencement of construction (See ESC24).
- Minimizing the impact of dust by anticipating the direction of prevailing winds.
- Direct most construction traffic to stabilized roadways within the project site (See ESC23).
- *Comply with the State DOH requirements for dust control.*

REQUIREMENTS

- Maintenance
  - Most dust control measures require frequent, often daily, attention.
- Cost
  - Installation costs for water/chemical dust suppression are low, but annual costs may be quite high since these measures are effective for only a few hours to a few days.

LIMITATIONS

- Watering prevents dust only for a short period and should be applied daily (or more often) to be effective.
- Overwatering may cause erosion.
- Oil should not be used for dust control because the oil may migrate into drainageway and/or seep into the soil.
- Certain chemically-treated subgrades may make soil water repellant, increasing runoff.

Targeted Pollutants

- ● Sediment
- ○ Nutrients
- ◒ Toxic Materials
- ◒ Oil & Grease
- ○ Floatable Materials
- ○ Other Construction Waste

- ● Likely to Have Significant Impact
- ○ Probable Low or Unknown Impact

Implementation Requirements

- ○ Capital Costs
- ◒ O&M Costs
- ◒ Maintenance
- ○ Training
- ○ Suitability for Slopes >5%

● High ○ Low

ESC21

BEST MANAGEMENT PRACTICES

ADDITIONAL INFORMATION: DUST CONTROLS

Dust Control Practices

Dust control BMP's generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. Table ESC21.1 shows which Dust Control BMPs apply to site conditions which cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel or asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching and sand fences can be employed for areas of occasional or no construction traffic. Preventive measures would include minimizing surface areas to be disturbed, limiting on-site vehicle traffic to 15 miles per hour, and controlling the number and activity of vehicles on a site at any given time.

Many of the reasonably available control measures for controlling dust from construction sites can also be implemented as BMPs for storm water pollution prevention. Those BMPs include:

- Pave, vegetate, or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for wet suppression or chemical stabilization of exposed soils.
- Provide for rapid clean-up of sediments deposited on paved roads. Furnish stabilized construction road entrances and vehicle wash down areas.
- Stabilize unpaved haul roads, parking and staging areas. Reduce speed and trips on unpaved roads.
- Implement dust control measures for material stockpiles.
- Prevent drainage of sediment laden storm water onto paved surfaces.
- Stabilize abandoned construction sites using vegetation or chemical stabilization methods.
- Limit the amount of areas disturbed by clearing and earth moving operations by scheduling these activities in phases.

For the chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. The types of chemicals available and recommendations for their use are tabulated in Table ESC21.2, Commonly Used Chemicals for Dust Control.

ESC21

ADDITIONAL INFORMATION: DUST CONTROLS

In addition, there are many other BMPs identified in this handbook that provide dust control including:

- Seeding and Plantings (ESC10)
- Mulching (ESC11)
- Construction Road Stabilization (ESC23)
- Stabilized Construction Entrances (ESC24)

Limitations

- Oil treated subgrades should not be used because the oil may migrate into drainageways and/or seep into the soil.
- Chemically treated subgrades may make the soil water repellant, interfering with long-term infiltration, and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly.
- Asphalt, as a mulch tack or chemical mulch, requires a 24 hour curing time to avoid adherence to equipment, worker shoes, etc. Application should be limited because asphalt surfacing may eventually migrate into the drainage system.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

California Air Pollution Control Laws, California Air Resources Board. 1992.

CalTrans, Standard Specifications, Sections 10, "Dust Control Section 17, "Watering"; and Section 18, "Dust Palliative".

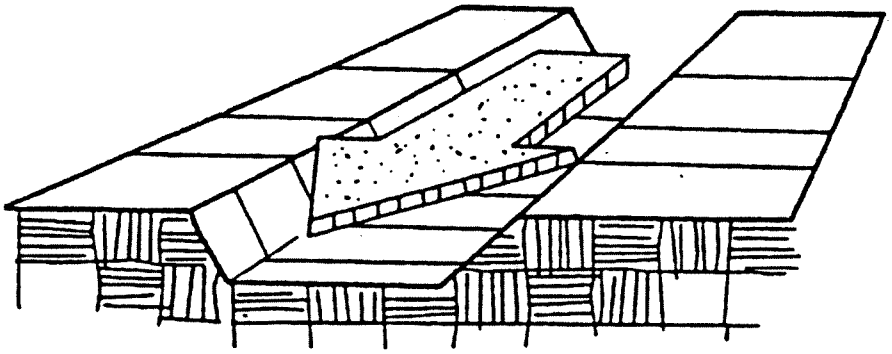
Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide, California Air Resources Board, April 1991.

Sacramento County, Winterization Ordinance & Dust Control Ordinance (example).

USDA Soil Conservation Service, "Guides for Erosion and Sediment Control".

ESC21

BMP: TEMPORARY DRAINS AND SWALES



Objectives

- *Housekeeping Practices*
- *Contain Waste*
- *Minimize Disturbed Areas*
- *Stabilize Disturbed Areas*
- *Protect Slopes/Channels*
- *Control Site Perimeter*
- *Control Internal Erosion*

GENERAL DESCRIPTION

Temporary drains and swales are used to divert off-site runoff around the construction site, divert runoff from stabilized areas around disturbed areas, and direct runoff into sediment basins or traps.

SUITABLE APPLICATIONS

Temporary drains and swales are appropriate for diverting any upslope runoff around unstabilized or disturbed areas of the construction site:

- Prevent slope failures.
- Prevent damage to adjacent property.
- Prevents erosion and transport of sediments into water ways.
- Increases the potential for infiltration.
- Diverts sediment-laden runoff into sediment basins or traps.

INSTALLATION/APPLICATION CRITERIA

Temporary drainage swales will effectively convey runoff and avoid erosion if built properly: Size temporary drainage swales using local drainage design criteria. A permanent drainage channel must be designed by a professional engineer (see the local drainage design criteria for proper design).

- At a minimum, the drain/swale should conform to predevelopment drainage patterns and capacities.
- Construct the drain/swale with an uninterrupted, positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drain or swale can reach an erosive velocity.

REQUIREMENTS

- Maintenance
  - Inspect weekly and after each rain.
  - Repair any erosion immediately.
  - Remove sediment which builds up in the swale and restricts its flow capacity.
- Cost
  - The cost of a drainage swale increases with drainage area and slope. Typically, swales for controlling internal erosion are inexpensive.

LIMITATIONS

- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local flood plain management requirements.

Targeted Pollutants

- ● *Sediment*
- ○ *Nutrients*
- ○ *Toxic Materials*
- ○ *Oil & Grease*
- ○ *Floatable Materials*
- ○ *Other Construction Waste*

- ● *Likely to Have Significant Impact*
- ○ *Probable Low or Unknown Impact*

Implementation Requirements

- ◒ *Capital Costs*
- ○ *O&M Costs*
- ○ *Maintenance*
- ○ *Training*
- ◒ *Suitability for Slopes >5%*

● *High* ○ *Low*

ESC31

BEST MANAGEMENT PRACTICES

ADDITIONAL INFORMATION: TEMPORARY DRAINS AND SWALES

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dike (see ESC30) at the top of a slope can safely divert runoff to a location where it can safely be brought to the bottom of the slope (see Pipe Slope Drain ESC32). A combination dike and swale is easily constructed by a single pass of a bulldozer or grader and compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded, and remain in place until post-construction BMPs are installed and/or the slopes are stabilized.

Diversion practices concentrate the volume of surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. A swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization, if significant erosion will occur. Any drain or swale which conveys sediment-laden runoff must be diverted into a sediment basin or trap before it is discharged from the site.

Installation/Application Criteria

Diversion drains or swales are only effective if they are properly installed. Swales are more effective than dikes because they tend to be more stable. The combination of a swale with a dike on the downhill side is the most cost-effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used *(see the City and County of Honolulu's "Storm Drainage Standards.")* Unless *the City and County of Honolulu* drainage design criteria state otherwise, drains or swales should be designed as follows:

- No more than 5 acres may drain to a temporary drain or swale
- Place the drain or swale above, not on, a cut and fill slope
- Swale bottom width should be at least 2 ft
- Depth of the swale should be at least 18 inches
- Side slopes should be 2:1 or flatter
- Drain or swale should be layed at a grade of at least 1 percent, but not more than 15 percent
- The swale must not be overtopped by the 10-year, 24-hour storm, irrespective of the design criteria stated above
- Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built
- Compact any fill material along the path of the swale
- Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use rip-rap or sod for swales with a slope between 5 and 15 percent
- Do not operate construction vehicles across a swale unless a stabilized crossing is provided.
- The cost of swales and other diversion devices is generally included in the earthwork cost, as a separate item under the grading budget of the project construction contract.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

"Draft - Sedimentation and Erosion Control, An Inventory of Current Practices", U.S.E.P.A., April, 1990.

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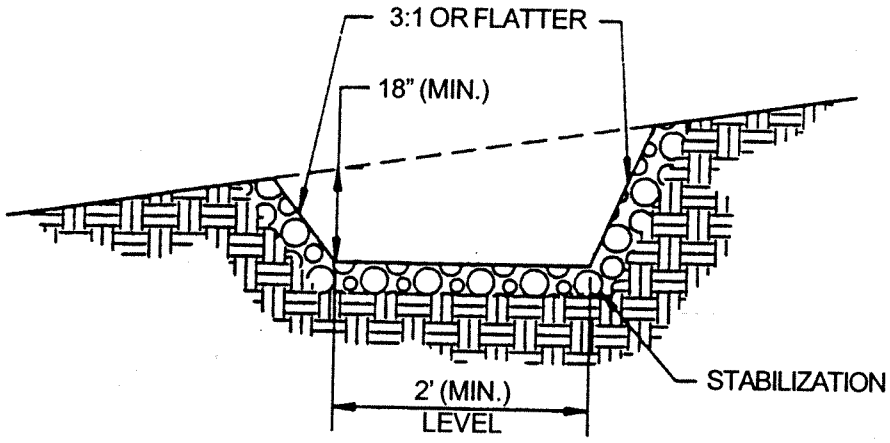
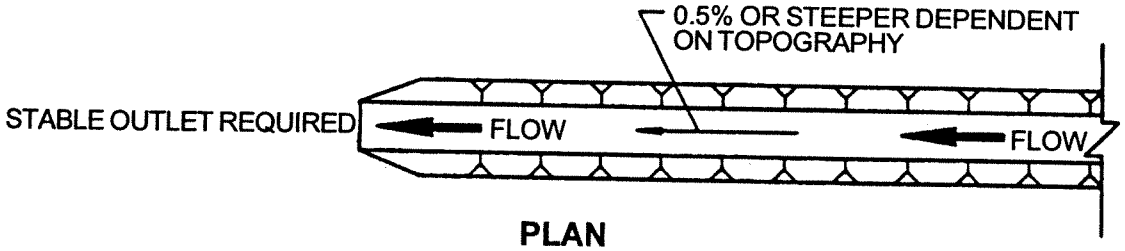
Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency - November 1988.

ESC31



CROSS SECTION



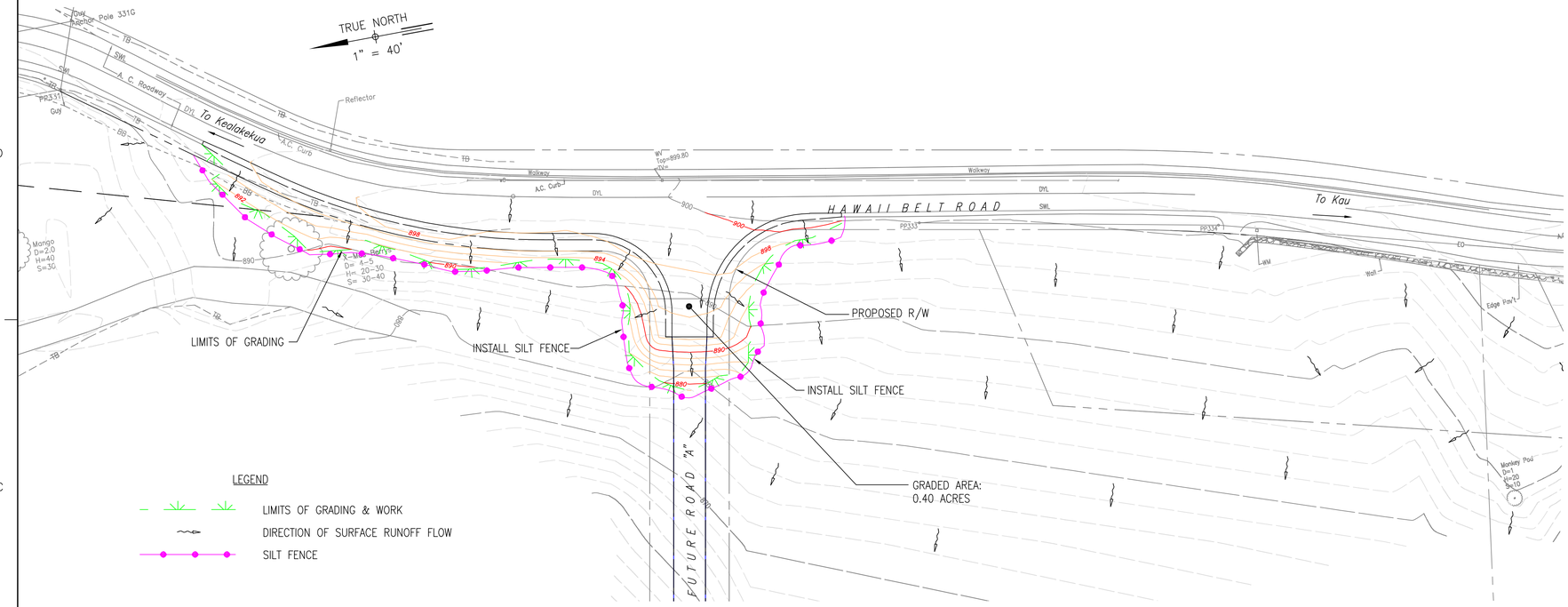
PLAN

TEMPORARY DRAINAGE SWALE

ESC31

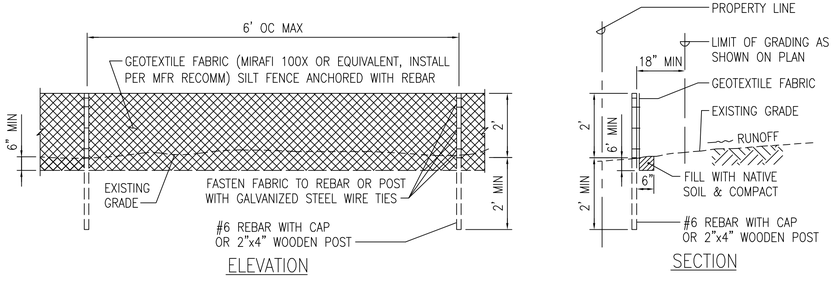
APPENDIX C

BMP Drawings



BEST MANAGEMENT PRACTICES PLAN – 1

SCALE: 1"=40'

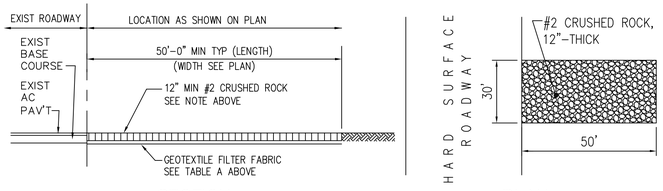


SILT FENCE

SCALE: NTS

TABLE A GEOTEXTILE REQUIREMENTS	
PHYSICAL PROPERTY	REQUIREMENTS
GRAB TENSILE STRENGH	220 LB (ASTM D1682)
ELONGATION FAILURE	60% (ASTM D1682)
MULLEN BURST STRENGH	430 LB (ASTM D3768)
PUNCTURE STRENGTH	125 LB (ASTM D751, MODIFIED)
EQUIVALENT OPENING	SIZE 40-80 (U.S. STD SIEVE, CW-02215)

NOTE: 12" CRUSHED ROCK LAYER SHALL BE REMOVED IMMEDIATELY PRIOR TO INSTALLATION OF ROADWAY BASE COURSE.



CONSTRUCTION INGRESS/EGRESS

SCALE: NTS

BEST MANAGEMENT PRACTICES NOTES:

1. DURING CONSTRUCTION, PREVENTIVE MEASURES SHALL BE USED TO CONTROL FORESEEABLE DUST, EROSION OR SEDIMENTATION PROBLEMS WHICH MAY ARISE AS THE JOB PROGRESSES.
2. THE CONSTRUCTION INGRESS AND EGRESS SHALL HAVE A 8" THICK CRUSHED ROCK LAYER LOCATED AT THE ENTRY FOR EACH PHASE OF WORK. SHOULD THE CONTRACTOR REQUIRE A INGRESS AND EGRESS, OTHER THAN WHAT IS SHOWN ON THE ECP, THE CONTRACTOR SHALL BE RESPONSIBLE TO OBTAIN ALL NECESSARY APPROVALS.
3. SLOPE AND EXPOSED AREAS SHALL BE SODDED OR PLANTED AS SOON AS FINAL GRADES HAVE BEEN ESTABLISHED. PLANTING SHALL NOT BE DELAYED UNTIL ALL GRADING HAS BEEN COMPLETED. GRADING TO FINAL GRADE SHALL BE CONTINUOUS AND ANY AREA WITHIN WHICH WORK HAS BEEN INTERRUPTED OR DELAYED SHALL BE PLANTED.
4. UNLESS INDICATED OTHERWISE IN THE SPECIAL PROVISIONS OR PROPOSAL, PAYMENT FOR PLANTING OR GRASSING REQUIRED UNDER THIS ITEM (OTHER THAN THAT SPECIFIED FOR LANDSCAPING) SHALL NOT BE PAID FOR DIRECTLY, BUT SHALL BE CONSIDERED INCIDENTAL TO AND INCLUDED IN THE PRICES BID FOR MASS GRADING.
5. NO WORK SHALL BE PERFORMED UNTIL ALL TEMPORARY BEST MANAGEMENT PRACTICES (BMPs) ARE IN-PLACE AND FUNCTIONING PROPERLY.
5. ALL TEMPORARY BEST MANAGEMENT PRACTICES (BMP'S) SHALL NOT BE REMOVED UNTILL ALL PERMANENT EROSION CONTROLS ARE IN PLACE AND ESTABLISHED.
6. CONTRACTOR SHALL NOT GRADE MORE THAN 5 ACRES AT ONE TIME. GRADING SHALL BE DONE IN PHASES.
7. THE CONTRACTOR SHALL ADJUST THE LOCATION OF GRAVEL INGRESS/EGRESS TO ACCOMMODATE THE INSTALLATION OF ROADWAY UTILITIES.
8. THE CONTRACTOR AT HIS OWN EXPENSE SHALL KEEP THE PROJECT AREA AND SURROUNDING AREA FREE FROM DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION CONTROL CHAPTER 11-60, "AIR POLLUTION CONTROL."
9. THE CONTRACTOR SHALL KEEP EXISTING AND NEW ROADWAYS FREE FROM SILT.
10. DRAINAGE SYSTEMS AS SHOWN ON THE CONSTRUCTION PLANS SHALL BE CONSTRUCTED AS EARLY AS PRACTICALLY POSSIBLE.
11. THE CONTRACTOR SHALL CONDUCT HIS GRADING OPERATIONS SO THAT EXCAVATION, EMBANKMENT AND IMPORTED MATERIAL SHALL BE DAMPENED WITH WATER DURING HIS GRADING OPERATIONS AT ALL TIMES.
12. SOLID WASTE DISPOSAL DURING GRUBBING AND GRADING ACTIVITIES SHALL MEET REQUIREMENTS OF ADMINISTRATIVE RULES, TITLE II, CHAPTER 58, SOLID WASTE MANAGEMENT CONTROL.
13. THE CONTRACTOR SHALL DETERMINE QUANTITY AND LOCATIONS OF ALL TEMPORARY SWALES THAT WILL BE REQUIRED TO DIVERT STORM WATER TO THE TEMPORARY SILTATION BASINS.
14. NO MORE THAN 5 ACRES MAY DRAIN TO A TEMPORARY SWALE.
15. CONTOURS SHOWN ARE BASED ON USGS QUAD MAP.
16. THE CONTRACTOR SHALL INSTALL A CONSTRUCTION NEW INGRESS/EGRESS AT THE BEGINNING OF EACH NEW PHASE.
17. THE CONTRACTOR SHALL PROVIDE SITE SPECIFIC BMP PLAN TO THE ENGINEER FOR SUBMISSION TO THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH.
18. LAND OWNERS SHALL BE RESPONSIBLE FOR DEVELOPMENT ACTIVITIES (HOUSE CONSTRUCTION, EARTHWORK, ETC.) PERFORMED WITHIN THEIR INDIVIDUAL LOTS SHOULD DISTURBANCE OF ONE (1) ACRE OR GREATER OCCUR. THEIR WORK SHALL COMPLY WITH NPDES REQUIREMENTS.
19. THE CONTRACTOR SHALL BE REACHABLE AT ALL TIMES SHOULD BMP FAILURE OCCUR. THE DOH-CWB SHALL BE NOTIFIED IN EVENTS OF FAILED BMPs THAT RESULT IN CONSIDERABLE AND NOTICEABLE IMPACT ON THE ENVIRONMENT.
20. BASELINE WATER SAMPLING SHALL BE CONDUCTED ALONG THE COASTLINE ADJACENT TO THE PROJECT FOR MONITORING AND ASSESSMENT PURPOSES.
21. INDIGENOUS OR POLYNESIAN-INTRODUCED PLANTS AND GROUNDCOVER TOLERANT TO DROUGHT, ULTRAVIOLET EXPOSURE AND MARINE (SALTY) ENVIRONMENTS SHALL BE USED FOR LANDSCAPING AND PERMANENT EROSION CONTROL.
22. THE CONTRACTOR SHALL INSPECT SILT FENCES ON A WEEKLY BASIS AND AFTER RAINFALL, REPAIRING THE FENCES WHENEVER THEY ARE DAMAGED AND REMOVING SILT WHEN IT REACHES ⅓ THE HEIGHT OF THE FENCE.

NUMBER	DATE	MADE BY	CHECKED	DESCRIPTIONS
				REVISIONS

ALAN Y. TOMITA — LICENSED PROFESSIONAL ENGINEER — NO. 4129-C — HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE DONE UNDER

REG. PROF. ENGR. <REG. NO.> DATE

M&E Pacific, Inc.
AN AECOM COMPANY
SUITE 500, PAUAHI TOWER · 1001 BISHOP ST., HONOLULU, HAWAII 96813

DRAWN BY: MSN
DEPT. CHECK: DYK
PROJ. CHECK: AYT

SCALE: 0 40 80 120 SCALE IN FEET

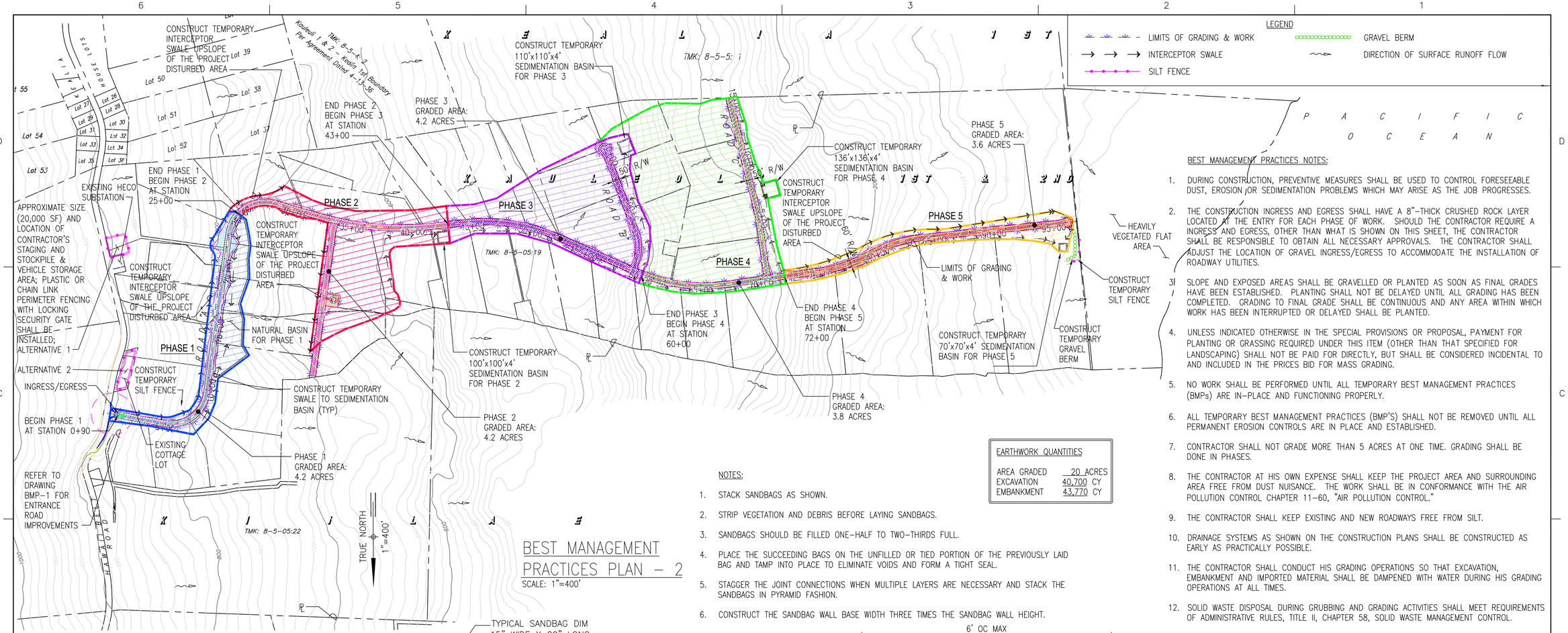
CMI, DEVELOPMENT, INC.
KIILAE FARMS
SUBDIVISION ROAD IMPROVEMENTS

ENTRANCE ROAD
BEST MANAGEMENT PRACTICES
OVERALL PLAN & DETAILS

MARCH 2004

JOB 036103148.0001.00001
FILE NO.
CADD FILE Kiilae-sd_BMP-1.dwg
DRAWING NO. BMP-1
SHEET 1 OF 2

PATH/FILENAME: P:\Projects\Vizes\V21681 Kiilae Subdivision\memo\MOV\Kiilae-sd_BMP-1.dwg
LAST UPDATE: May 26, 2004 @ 085141 am
PLOT DATE: May 26, 2004 @ 085225 am



BEST MANAGEMENT PRACTICES PLAN – 2

SCALE: 1"=400'

NOTES:

1. STACK SANDBAGS AS SHOWN.
2. STRIP VEGETATION AND DEBRIS BEFORE LAYING SANDBAGS.
3. SANDBAGS SHOULD BE FILLED ONE-HALF TO TWO-THIRDS FULL.
4. PLACE THE SUCCEEDING BAGS ON THE UNFILLED OR TIED PORTION OF THE PREVIOUSLY LAID BAG AND TAMP INTO PLACE TO ELIMINATE VOIDS AND FORM A TIGHT SEAL.
5. STAGGER THE JOINT CONNECTIONS WHEN MULTIPLE LAYERS ARE NECESSARY AND STACK THE SANDBAGS IN PYRAMID FASHION.
6. CONSTRUCT THE SANDBAG WALL BASE WIDTH THREE TIMES THE SANDBAG WALL HEIGHT.

EARTHWORK QUANTITIES

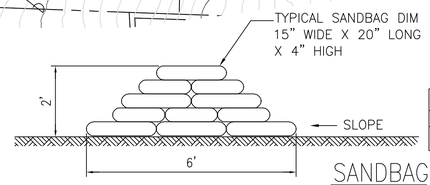
AREA GRADED	20 ACRES
EXCAVATION	40,700 CY
EMBANKMENT	43,770 CY

BEST MANAGEMENT PRACTICES NOTES:

1. DURING CONSTRUCTION, PREVENTIVE MEASURES SHALL BE USED TO CONTROL FORESEEABLE DUST, EROSION OR SEDIMENTATION PROBLEMS WHICH MAY ARISE AS THE JOB PROGRESSES.
2. THE CONSTRUCTION INGRESS AND EGRESS SHALL HAVE A 8"-THICK CRUSHED ROCK LAYER LOCATED AT THE ENTRY FOR EACH PHASE OF WORK. SHOULD THE CONTRACTOR REQUIRE A INGRESS AND EGRESS, OTHER THAN WHAT IS SHOWN ON THIS SHEET, THE CONTRACTOR SHALL BE RESPONSIBLE TO OBTAIN ALL NECESSARY APPROVALS. THE CONTRACTOR SHALL ADJUST THE LOCATION OF GRAVEL INGRESS/EGRESS TO ACCOMMODATE THE INSTALLATION OF ROADWAY UTILITIES.
3. SLOPE AND EXPOSED AREAS SHALL BE GRAVELLED OR PLANTED AS SOON AS FINAL GRADES HAVE BEEN ESTABLISHED. PLANTING SHALL NOT BE DELAYED UNTIL ALL GRADING HAS BEEN COMPLETED. GRADING TO FINAL GRADE SHALL BE CONTINUOUS AND ANY AREA WITHIN WHICH WORK HAS BEEN INTERRUPTED OR DELAYED SHALL BE PLANTED.
4. UNLESS INDICATED OTHERWISE IN THE SPECIAL PROVISIONS OR PROPOSAL, PAYMENT FOR PLANTING OR GRASSING REQUIRED UNDER THIS ITEM (OTHER THAN THAT SPECIFIED FOR LANDSCAPING) SHALL NOT BE PAID FOR DIRECTLY, BUT SHALL BE CONSIDERED INCIDENTAL TO AND INCLUDED IN THE PRICES BID FOR MASS GRADING.
5. NO WORK SHALL BE PERFORMED UNTIL ALL TEMPORARY BEST MANAGEMENT PRACTICES (BMPs) ARE IN-PLACE AND FUNCTIONING PROPERLY.
6. ALL TEMPORARY BEST MANAGEMENT PRACTICES (BMP'S) SHALL NOT BE REMOVED UNTIL ALL PERMANENT EROSION CONTROLS ARE IN PLACE AND ESTABLISHED.
7. CONTRACTOR SHALL NOT GRADE MORE THAN 5 ACRES AT ONE TIME. GRADING SHALL BE DONE IN PHASES.
8. THE CONTRACTOR AT HIS OWN EXPENSE SHALL KEEP THE PROJECT AREA AND SURROUNDING AREA FREE FROM DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION CONTROL CHAPTER 11-60, "AIR POLLUTION CONTROL."
9. THE CONTRACTOR SHALL KEEP EXISTING AND NEW ROADWAYS FREE FROM SILT.
10. DRAINAGE SYSTEMS AS SHOWN ON THE CONSTRUCTION PLANS SHALL BE CONSTRUCTED AS EARLY AS PRACTICALLY POSSIBLE.
11. THE CONTRACTOR SHALL CONDUCT HIS GRADING OPERATIONS SO THAT EXCAVATION, EMBANKMENT AND IMPORTED MATERIAL SHALL BE DAMPENED WITH WATER DURING HIS GRADING OPERATIONS AT ALL TIMES.
12. SOLID WASTE DISPOSAL DURING GRUBBING AND GRADING ACTIVITIES SHALL MEET REQUIREMENTS OF ADMINISTRATIVE RULES, TITLE 11, CHAPTER 58, SOLID WASTE MANAGEMENT CONTROL.
13. THE CONTRACTOR SHALL DETERMINE QUANTITY AND LOCATIONS OF ALL TEMPORARY SWALES THAT WILL BE REQUIRED TO DIVERT STORM WATER TO THE TEMPORARY SILTATION BASINS.
14. NO MORE THAN 5 ACRES MAY DRAIN TO A TEMPORARY SWALE.
15. CONTOURS SHOWN ARE BASED ON USGS QUAD MAP.
16. THE CONTRACTOR SHALL PROVIDE SITE-SPECIFIC CONSTRUCTION BMP PLAN TO THE ENGINEER FOR APPROVAL AND SUBMISSION TO THE DEPARTMENT OF HEALTH, CLEAN WATER BRANCH.
17. LAND OWNERS SHALL BE RESPONSIBLE FOR DEVELOPMENT ACTIVITIES (HOUSE CONSTRUCTION, EARTHWORK, ETC.) PERFORMED WITHIN THEIR INDIVIDUAL LOTS SHOULD DISTURBANCE OF ONE (1) ACRE OR GREATER OCCUR. THEIR WORK SHALL COMPLY WITH NPDES REQUIREMENTS.
18. THE CONTRACTOR SHALL BE REACHABLE AT ALL TIMES SHOULD BMP FAILURE OCCUR. THE DOH-CWB SHALL BE NOTIFIED IN EVENTS OF FAILED BMPs THAT RESULT IN CONSIDERABLE AND NOTICEABLE IMPACT ON THE ENVIRONMENT.
19. BASELINE WATER SAMPLING SHALL BE CONDUCTED ALONG THE COASTLINE ADJACENT TO THE PROJECT FOR MONITORING AND ASSESSMENT PURPOSES.
20. INDIGENOUS OR POLYNESIAN-INTRODUCED PLANTS AND GROUNDCOVER TOLERANT TO DROUGHT, ULTRAVIOLET EXPOSURE AND MARINE (SALTY) ENVIRONMENTS SHALL BE USED FOR LANDSCAPING AND PERMANENT EROSION CONTROL.

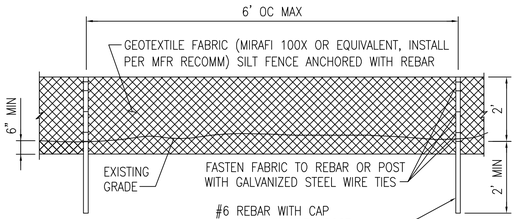
TABLE A GEOTEXTILE REQUIREMENTS	
PHYSICAL PROPERTY	REQUIREMENTS
GRAB TENSILE STRENGH	220 LB (ASTM D1682)
ELONGATION FAILURE	60% (ASTM D1682)
MULLEN BURST STRENGH	430 LB (ASTM D3768)
PUNCTURE STRENGTH	125 LB (ASTM D751, MODIFIED)
EQUIVALENT OPENING	SIZE 40-80 (U.S. STD SIEVE, CW-02215)

NOTE: 12" CRUSHED ROCK LAYER SHALL BE REMOVED IMMEDIATELY PRIOR TO INSTALLATION OF ROADWAY BASE COURSE.

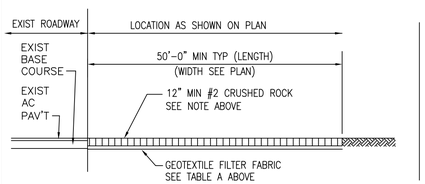


SANDBAG
SCALE:

ESTIMATED MATERIALS REQUIRED FOR 100 LF		
HEIGHT	SANDBAGS REQ'D	TONS OF SAND
2'	823	12.3 Tons

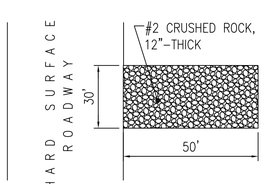


ELEVATION

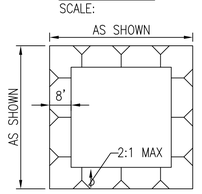


SECTION

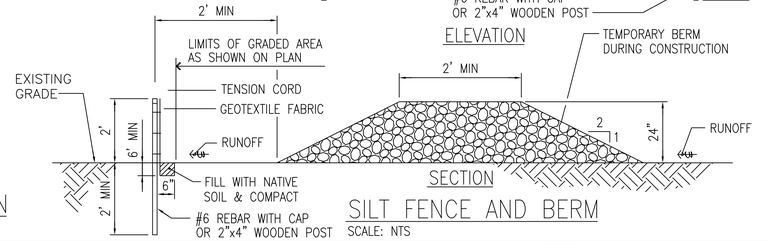
CONSTRUCTION INGRESS/EGRESS
SCALE: NTS



PLAN



TEMPORARY SEDIMENTATION BASIN
SCALE: NTS



SECTION

SILT FENCE AND BERM
SCALE: NTS

NUMBER	DATE	MADE BY	CHECKED	DESCRIPTIONS

REVISIONS

ALAN Y. TOMITA LICENSED PROFESSIONAL ENGINEER NO. 4129-C HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE DONE UNDER

REG. PROF. ENGR. <REG. NO.> DATE

M&E Pacific, Inc.
AN AECOM COMPANY
SUITE 500, PAUAHI TOWER · 1001 BISHOP ST., HONOLULU, HAWAII 96813

DRAWN BY: MSN
DEPT. CHECK: DYK
PROJ. CHECK: AYT

SCALE: 0 400 800 1200 SCALE IN FEET

UNLESS OTHERWISE NOTED OR CHANGED BY REPRODUCTION

CMI, DEVELOPMENT, INC.
KIILAE FARMS
SUBDIVISION ROAD IMPROVEMENTS

SUBDIVISION ROAD
BEST MANAGEMENT PRACTICES
OVERALL PLAN & DETAILS

MARCH 2004

JOB 036103148.0001.00001
FILE NO.
CADD FILE Kiilae-sd_BMP-2.dwg
DRAWING NO. BMP-2
SHEET 2 OF 2

PATH/FILENAME: P:\Projects\Users\JG1181 Kiilae Subdivision\mxmx\XDATA\Kiilae-sd_BMP-2.dwg
LAST UPDATE: April 29, 2004 @ 12:53:52 pm
PLOT DATE: May 26, 2004 @ 08:48:13 am